

# MONTHLY WEATHER REVIEW.

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## INTRODUCTION.

The general weather conditions which prevailed over the United States and Canada during July, 1883, are presented in this REVIEW, based upon reports received from the regular stations of the Signal Service, from the Canadian Meteorological Service, and from co-operating state weather services and voluntary observers.

The following may be mentioned as the most noteworthy meteorological features of the month:

The large deficiencies in the monthly rainfall in the southern states and in the northern districts west of the 92d meridian resulted in drought in many localities, the most serious occurring in the eastern Gulf states. A comparison of the average precipitation for the several districts in the cotton region with that of July, 1882, shows deficiencies ranging from 0.69 inch in the district of Little Rock to 6.82 inches in the district of Vicksburg.

The mean temperature has been below the average in all parts of the United States, except on the Pacific coast and in the south Atlantic and east Gulf states, but the departures have not been unusually marked.

The severest local storms of the month occurred on the 12th and 13th, from Indiana westward to the eastern portions of Nebraska and Kansas, and on the 21st in Minnesota, Wisconsin, and Michigan.

Violent electrical storms were of great frequency, and numerous instances of serious damage by lightning have been reported.

The ice-chart, compared with that of June, shows that there has been a marked change in the extent of the ice region, the eastern limit having moved about two degrees to the westward, and, compared with the ice-chart of July, 1882, shows a great change in the positions of the limits of the ice region, and also a very marked diminution in the number of icebergs observed.

In the preparation of this REVIEW, the following data, received up to August 20th, have been used; viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-two Signal Service stations and thirteen Canadian stations, as telegraphed to this office; one hundred and fifty-four monthly journals, and one hundred and thirty-eight monthly means from the former, and thirteen monthly means from the latter; two hundred and eighteen monthly registers from voluntary observers; fifty monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports, through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Illinois, Indiana, Iowa, New Jersey, and Tennessee, and of the

Central Pacific railway company; trustworthy newspaper extracts; and special reports.

## ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean atmospheric pressure for the month of July, 1883, determined from the tri-daily telegraphic observations of the Signal Service, is shown by the isobarometric lines on chart iii.

The regions of greatest mean pressure occupy about the same positions as in the preceding month, viz: the north Pacific coast, and the south Atlantic and Gulf states, but over the north Pacific coast region the pressure has decreased about .05, while a corresponding increase has taken place over the south Atlantic and Gulf states. The highest barometric mean for the month, 30.11, is reported from Cedar Keys, Florida. The isobar of 30.05 extends from eastern Texas, northward to southern Illinois, and thence eastward to the North Carolina coast, inclosing the short isobar of 30.1, which is traced near the northern boundary of Florida. Southward from Cedar Keys, the pressure decreases to 30.09 at Key West. On the north Pacific coast the isobar of 30.0 extends from the coast of southern Oregon northeastward to the northern boundary of Washington territory. The area of least mean pressure covers Utah, Colorado, Arizona, and a part of New Mexico, and is inclosed by the isobar of 29.85. The lowest barometric means, 29.79 and 29.80, are reported from Yuma, Arizona, and West Las Animas, Colorado.

The mean pressure of July, compared with that of June, shows decreases varying from .01 to .05 in the middle and north Pacific coast regions, and from .01 to .09 over the Canadian Maritime provinces, New England, and the northern portion of the middle Atlantic states. In all other parts of the country the mean pressure is greater than that of the preceding month. Over the Rocky mountain districts, the extreme northwest, Missouri valley, the eastern part of the lower lake region, and on the Atlantic coast south of New Jersey, the increase varies from .01 to .05. Over the remainder of the country, where an increase has taken place, the departures vary from .05 to .12, being greatest in the Rio Grande valley.

## DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Over the Rocky mountain regions, Ohio valley, middle Atlantic and southern states, the mean pressure is above the normal for July. The departures in these districts are generally less than .05, the only exceptions being .06 at Galveston, Texas; .07 at Fort Shaw, Montana, and .08 at Brownsville, Texas. The pressure is below the normal in southern California, the north Pacific coast region, over the northern districts from New England westward to Dakota, in the Missouri valley, eastern Colorado, and northern Texas. The only departures exceeding .05 in the districts where the deficiencies occur, are .06 at Port Huron, Michigan, and .08 at Duluth, Minnesota.

## BAROMETRIC RANGES.

The monthly barometric ranges have been greatest in the extreme northwest and in the northern part of the upper lake region, where they have varied from .73 to .85. They are least in the southern states, Rocky mountain districts, and in California. The stations reporting the smallest ranges are Key West, Florida, .18; and Fort Apache, Arizona, .25.

The monthly ranges have varied in the different districts as follows:

*New England.*—From 0.46 on the summit of Mount Washington, New Hampshire, to 0.62 at Eastport, Maine.

*Middle Atlantic states.*—From 0.50 at Lynchburg, Virginia, to 0.58 at Cape Henry, Virginia.

*South Atlantic states.*—From 0.38 at Charleston, South Carolina, to 0.56 at Hatteras and Kittyhawk, North Carolina.

*Florida.*—From 0.18 at Key West, to 0.32 at Sanford.

*Eastern Gulf.*—From 0.28 at New Orleans, Louisiana, to 0.40 at Montgomery, Alabama.

*Western Gulf.*—From 0.32 at Galveston, Texas, to 0.52 at Fort Smith, Arkansas.

*Ohio valley and Tennessee.*—From 0.50 at Chattanooga, Tennessee, to 0.62 at Indianapolis, Indiana.

*Lower lakes.*—From 0.54 at Erie, Pennsylvania, to 0.59 at Detroit, Michigan.

*Upper lakes.*—From 0.64 at Chicago, Illinois, to 0.74 at Duluth, Minnesota, and at Mackinaw City and Marquette, Michigan.

*Extreme northwest.*—From 0.75 at Moorhead, Minnesota, to 0.85 at Bismarck, Dakota.

*Upper Mississippi valley.*—From 0.62 at Cairo, Illinois, to 0.71 at La Crosse, Wisconsin, and Saint Paul, Minnesota.

*Missouri valley.*—From 0.60 at Omaha, Nebraska, to 0.74 at Huron, Dakota.

*Northern slope.*—From 0.38 at Helena, Montana, to 0.64 at North Platte, Nebraska.

*Middle slope.*—From 0.42 at Denver, Colorado, to 0.50 at West Las Animas, Colorado.

*Southern slope.*—From 0.40 at Fort Stockton, Texas, to 0.41 at Fort Concho, Texas.

*Southern plateau.*—From 0.25 at Fort Apache, Arizona, to 0.40 at El Paso, Texas.

*Northern plateau.*—From 0.37 at Spokane Falls, Washington Territory, to 0.43 at Lewiston, Idaho.

*North Pacific coast.*—From 0.48 at Roseburg, Oregon, to 0.50 at Portland, Oregon.

*Middle Pacific coast.*—From 0.40 at San Francisco, California, to 0.51 at Red Bluff, California.

*South Pacific coast.*—From 0.27 at Los Angeles, California, to 0.34 at Yuma, Arizona.

#### AREAS OF HIGH BAROMETER.

Four areas of high barometer have been traced over the districts east of the Rocky mountains during the month. The general course of the movement of these areas was to the southeast, inclining more to the south than usual, and in each case passing over the Atlantic from the west and south of the lake region, while in the month immediately preceding, the four areas traced passed to the Atlantic north of the Ohio valley. In addition to the areas of high barometer traced within the limits of the stations of observation, several waves of high pressure appeared on the north Pacific coast during the month, but in no case has it been possible to trace these waves of pressure eastward of the Rocky mountains as defined high areas, while the daily charts of barometric change show the gradual advance of these pressure waves from the Pacific to the Atlantic coast.

I.—This area of high pressure appeared north of the upper lake region on the 30th of last month, and moved southward to the Ohio valley, where it was central on the morning of the 1st of July. During the 2d and 3d it moved southeastward off the south Atlantic coast, and apparently extended along the coast from Florida to Nova Scotia, where the pressure was 30.20 on the morning of the 4th. The increase of pressure at the northeastern stations indicates that this area moved east or northeast after leaving the coast-line. The continued south and southwest winds which followed the transit of this area over the southern, middle, and New England states, caused the temperature to rise to the maximum of the month at many stations.

II.—This area was observed in British America west of Hudson's bay on the morning of the 7th, when the storm, traced as number iii., was central near Lake Ontario. On the morning of the 8th it was central near Lake Superior, the temperature having fallen from 10° to 20° in the lower lake region during the past twenty-four hours, and cool northerly winds and clear weather prevailed in the upper lake region and the upper Mississippi valley. After passing Lake Superior on the 8th, the course of this area was almost southerly, inclining first to the southwest, and then following the Mississippi valley, the greatest pressure being reported at Cairo, Illinois, on the morning of the 10th. The pressure increased slowly at the Atlantic coast stations, with a slight fall of temperature, while this area of high pressure moved southward over the central valley. It was last observed near the southern part of Florida, on the morning of the 11th.

III.—This area was first observed as an extended wave of high pressure on the morning of the 17th, probably central in the Missouri valley and following the well defined low area, traced as number vii. The barometer was relatively high at the stations near the boundary from Manitoba to Oregon, and the reports indicate that this cool wave first appeared on the north Pacific coast as the pressure was above the normal in that region on the 15th and 16th. This area moved slowly to the eastward during the 18th and 19th, passing over Missouri and the Ohio valley, attended by cool and generally clear weather in all districts. The morning report of the 20th indicated a pressure of 30.20 and above in the southern portions of the middle Atlantic states, which at this time was included in this area. It passed to the east of the coast stations, extending from north to south from New England to Florida, on the 21st, when the greatest pressure was to the east of the North Carolina coast. The tri-daily charts of 22d, 23d, 24th, and 25th, show that this area of high pressure apparently moved to the southwest, after passing to the east of the Atlantic coast stations, the centre of greatest pressure being located in Georgia on the 23d, and south of Mississippi and Louisiana on the 24th and 25th. The pressure continued high in the southern portions of the United States during the 26th and 27th, and this area did not disappear wholly from that region until the 28th.

High area number iv., appeared in British America, north of Dakota, on the 28th, the pressure having been above the normal on the north Pacific coast on the 24th, 25th, and 26th. This area extended southward over the Mississippi valley as far as the Gulf coast, the greatest pressure being in Iowa on the morning of that day, and also on the morning of the 30th, although it was one-tenth of an inch less on the last named day. It moved southeastward from Iowa to Florida during the 30th and 31st, causing a slight fall in temperature, and attended by light showers at stations to the south and east of the greatest pressure.

The waves of high pressure observed on the Pacific coast did not pass to the south of central California, and in most cases were only indicated by the pressures reported at the most northerly stations. These waves were observed on the following dates: from the 11th to the morning of the 14th; from midnight of the 14th to the 16th; from the 18th to the 19th; from the 22d to the 26th; and from the 29th to the 31st.

#### AREAS OF LOW BAROMETER.

Eight areas of low barometer have been traced from the tri-daily telegraphic reports. The tracks of the centres of these areas are shown on chart number i. In no case has an area of low barometer appeared in the southern states, and only one passed to the eastward south of New England. Four of these storms apparently developed in the Rocky mountain regions, and three passed so far to the north of the lake region from northwestern British America as to make the location of the centre of disturbance only approximate. No depression has been traced from the Pacific coast eastward.

The following table shows the latitudes and longitudes in

which each depression was first and last observed, and the hourly velocity of each depression:

Areas of low barometer.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	51 00	97 00	52 00	63 00	39.0
II.	38 00	107 00	51 00	62 00	41.0
III.	37 00	108 00	45 00	61 00	30.5
IV.	53 00	96 00	51 00	81 00	42.0
V.	53 00	99 00	50 00	69 00	24.0
VI.	53 00	102 00	50 00	92 00	28.0
VII.	46 00	106 00	51 00	66 00	28.0
VIII.	37 00	104 00	37 00	73 00	18.5
Mean hourly velocity.....					31.4

I.—This disturbance developed in British America during the latter part of June, and was central in Manitoba on the morning of the 1st of July. It moved slightly to the southward during the 1st, approaching Lake Superior, where brisk southerly winds occurred, while the centre of disturbance was north of the upper lake region. The easterly movement of this depression was slightly retarded as it passed near the lake region on the 1st, but it passed rapidly down the Saint Lawrence valley on the 2d, increasing in energy and causing severe gales at stations near the centre of disturbance. When first observed in the northwest the barometer at the centre read 29.66, and when last observed in the northeast the barometer at the centre had fallen to 29.31. The rain area attending this disturbance extended over the lake region, New England, and New York, but the rainfalls were light and of short duration.

II.—This disturbance was developing slowly in the Rocky mountain region when the preceding low area was passing off the coast of New Brunswick. It was apparently central in Colorado on the afternoon of the 2d, but passed northeastward to southern Dakota during the night, afterwards returning to eastern Colorado before moving eastward over the lake region. The 11 p. m. tri-daily chart of the 3d shows a trough of low pressure extending from northeast to southwest, over the upper lake region and northwest, with apparently two centres of disturbance—one near Saint Paul, Minnesota, which is given on the storm-track, and a second near Cheyenne, Wyoming. The last named disturbance apparently moved to the southwest, and formed a part of an extended low area which was afterwards traced as number iii. The principal disturbance moved rapidly northeastward after passing the Mississippi valley, and disappeared to the east of the Gulf of Saint Lawrence on the 5th. This disturbance did not extend south of the Ohio valley and the pressure did not fall below 29.70 at stations near its centre.

III.—This storm developed in western Colorado on the 4th, and remained almost stationary in that region until the morning of the 6th, when the centre was located near West Las Animas, the barometer indicating a pressure of 29.67 at that station at 11 p. m. of the 5th, and 29.77 at the 7 a. m. report of the 6th, with a general increase of pressure and northerly winds in Colorado, thus indicating an easterly movement of the disturbance. On the afternoon of the 6th there was a well-marked low area in the upper Mississippi valley, and local rains were reported in the central valley and lake region. Strong north and west winds prevailed at stations in the Missouri valley, Kansas, and Nebraska, and violent local storms occurred in Minnesota. At midnight of the 3d this storm was central in eastern Wisconsin, the isobar of 29.70 inclosing the centre and extending east and west south of Lake Superior. Very heavy rains and destructive storms occurred in Michigan and Wisconsin during the night of the 6th. The morning reports of the 7th showed a contraction of the central area in a north and south direction, probably due to the advance of a volume of cool air from the north, previously referred to as high area number ii. This disturbance passed from north of Lake Ontario to east Nova Scotia during the 7th, but rain con-

tinued in the northern districts until the 8th, and on the middle Atlantic and New England coasts until the 9th. A secondary depression developed on the middle Atlantic coast after the principal area had passed over the Atlantic, causing heavy rains and violent local winds at stations between Cape Hatteras, North Carolina, and Sandy Hook, New Jersey.

IV.—This depression was at no time within the limits of the territory of the United States. On the afternoon of the 9th a slight depression appeared north of Manitoba, and the succeeding report indicated that this disturbance passed directly eastward north of the lake region. The location of the centre of this area is approximately given for the 11 p. m. report of the 9th, and the 7 a. m. report of the 10th. Local rains occurred in the lake region and Saint Lawrence valley on the 10th.

V.—This was a well-marked disturbance which appeared north of Minnesota on the morning of the 11th. It moved southeastward during the 11th, the pressure near the centre being near 29.50, and at midnight the centre was near Duluth, Minnesota, with cool northerly winds at Saint Vincent, Minnesota, and Fort Garry, Manitoba. After reaching the lake region the course changed to easterly, and the storm continued in this direction until the afternoon report of the 12th, when its course changed to the northeast, near Saugeen, Ontario. This was a general disturbance, causing rain in all districts north of the Gulf states. When this disturbance passed over the Saint Lawrence valley, it was apparently retarded, losing much of its energy, while becoming much extended.

VI.—Appeared in British America, on the 13th, and passed southeastward towards Lake Superior, but was last observed as central north of Duluth on the afternoon of the 14th. Although there were indications of a slight depression in the lake region following that report, no well-marked area could be located.

VII.—On the morning of the 15th a well-defined low area was central in the Yellowstone valley, near Fort Keogh, Montana, inclosed by an elliptical isobar of 29.70. This depression moved first southward to eastern Colorado, and after the afternoon report of the 15th it moved to the northeast or east. On the morning of the 16th the storm was central immediately west of Duluth, and at the 3 p. m report of the same day it was central near and northeast of that station, the barometer falling to 29.50, and wind sw., 24 miles. The centre passed directly east during the succeeding reports, attended by severe local storms in the northern portions of the lake region, during the night of the 17th. After reaching the Saint Lawrence valley the course changed to the northeast, and this movement continued until the storm passed beyond the stations of observation, on the 18th.

VIII.—The atmospheric pressure was below the normal at the stations west of the Mississippi valley during the 20th and 21st, and slight depressions formed north of Dakota and on the eastern slope of the Rocky Mountains. The depression traced as number viii. was central in southeastern Colorado at 3 p. m. of the 20th, and it remained in that region until the 23d, moving first to northern Texas, then to southern Dakota, thence back to eastern Colorado and western Nebraska, after which it passed eastward over southern Dakota and southern Minnesota, the course then changing to southeast after passing the Mississippi valley, and crossed the eastern portion of the United States during the 23d and 24th, leaving the Virginia coast as a well marked disturbance. This was the only disturbance occurring during the month which passed south of the lake region. It was well defined, but the depression at the centre was not greater than 29.70.

#### NORTH ATLANTIC STORMS DURING JULY, 1883.

[Pressure expressed in inches and in millimetres; wind-force by scale of 0—10.]

Chart ii. exhibits the tracks of the principal depressions that have moved over the north Atlantic ocean during July, 1883.

The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in